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DDAS Accident Report

Accident details

Report date: 12/07/2013	Accident number: 795
Accident time: 09:40	Accident Date: 03/03/2012
Where it occurred: Daphniya Police Station, Zliten	Country: Libya
Primary cause: Other (?)	Secondary cause: Management/control inadequacy (?)
Class: Handling accident	Date of main report: 12/03/2012
ID original source: None	Name of source: LMAC Libya
Organisation: [Name removed]	
Mine/device: Type 84 AT	Ground condition: Ammunition Storage Area demolition site (explosives)
Date record created:	Date last modified: 12/07/2013
No of victims: 1	No of documents: 2

Map details

Longitude:	Latitude:
Alt. coord. system:	Coordinates fixed by: GPS
Map east: E 014 47.505	Map north: N 032 24.871
Map scale:	Map series:
Map edition:	Map sheet:
Map name:	

Accident Notes

Inadequate investigation (?)

Inconsistent statements (?)

Protective equipment not worn (?)

Visor not worn (?)

Accident report

The report of this accident was made available in separate files in 2012. The conversion into a DDAS file has led to some of the original formatting being lost. Extensive backup files are held on record. Text in square brackets [] is editorial.

Board of Inquiry Report

[Demining group], Libya (Daphniya)
Fatal Accident - 03 March 2012

Report date: 12 March 2012

An enquiry was ordered by the UNMAS Programme Manager in Libya (JMACT)
Board of Inquiry Report – [Demining group] Libya Fatal Accident (03 March 2012)

References:

[Demining group] Initial Demining Incident Report of 051816B March 2012. (Annex A)
JMACT Accident Board of Inquiry Convening Order of 06 March 2012. (Annex B). [Annexes held on record.]

1 Introduction

A Board of Inquiry was formed by the UN Joint Mine Action Coordination Centre (JMACT) [UNMAS] Libya to undertake a formal investigation into a fatal accident involving [Demining group] staff in Daphniya, Libya on Saturday 03 March 2012.

The Terms and Definitions used within this report are consistent with IMAS 04.10 Glossary of mine action terms, definitions and abbreviations.

The accident investigation methodology was based on the requirements of IMAS 10.60 Safety and occupational health – Reporting and investigation of demining accidents.

2 Details of incident

2.1 Background

At between 2100 hours and 2200 hours on Wednesday, 29 February 2012 there was an undesirable explosion in a containerised ammunition storage site at the Daphniya Police Station. Alternative spellings include Dafnia and Daphnia. Daphniya has been used for consistency in this report.) Daphniya is located on the main route from Tripoli to Misurata (Alternative spellings include Misurata. Misurata has been used for consistency in this report.) and the Daphniya Police Station mans a major checkpoint on this route. On this evening tensions between local communities and rival 'Katibas' were high and access to the locked ammunition container became a disputed issue.

Verbal evidence from the local population suggests that the explosion occurred as a result of an individual firing either an Assault Rifle (calibre unknown) into the padlock of the container, or an RPG-7 fired into the container; there is conflicting evidence as to the exact type of weapon that started the fire. Once access was gained the perpetrators immediately noticed a small fire, and they evacuated the area rapidly. The fire spread until there was an explosion involving at least 11 of the 22 x 20' ISO Containers. The following fuzed ammunition was positively identified as being involved in the accident:

- 106mm Heat Recoilless;
- 120mm Mortar;
- 82/84mm Mortar;
- Hand Grenades;
- RPG-7;
- 107mm Type 63 Rocket;
- 130mm HE Rocket; and
- Chinese 122-15 ATML Free Flight Rocket (122mm) – Contained Type 84 Scatterable AT Mines.

Much ammunition was destroyed during the initial explosion, but damaged and undamaged fuzed ammunition was spread out to a radius of at least 400m. As the containers involved in the explosion were within the centre of the grouping of the containers the ejection of this fuzed ammunition was remarkably directional. Most of it being projected to the South of the

site. UXO density was also unusually light, as most of the ammunition seemed to have being destroyed in the initial explosion.

The remaining 11 containers appear relatively undamaged, but will require further EOD clearance. As the aim of this report is not to investigate the cause and effect of this ammunition depot explosion, the Board of Inquiry did not pursue much further information.

Mines involved in this incident have been positively confirmed as detonating 72 hours after the initial Daphniya explosion; this is possibly due to a self-destruct system (see later).

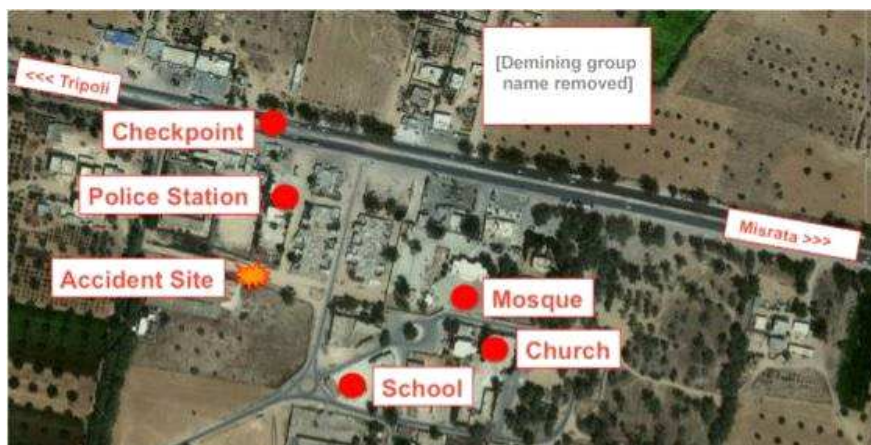


Image 1: Overview of Daphniya Area

2.2 EOD Clearance operation Thursday, 01 March 2012

At approximately 0805 hours [Demining group] EOD Teams 1, 2 and 3 and BAC1 reached Daphniya checkpoint and gathered for their morning meeting. At approximately 0807 hours the CLO's informed the EOD Team Leaders of the fighting the previous evening and that there was a UXO at the house by their normal meeting point. [Demining group] EOD Teams were at that time involved in routine clearance operations to the North of Daphniya checkpoint. The Operations Manager was informed at 0810 hours.

Further investigations by the CLO then suggested that there may still be a fire burning within the ammunition storage area, and that there was widespread UXO contamination. At 0821 hours an update was passed to the [Demining Group Ops Manager], and the decision was taken, after consultation with the JMACT [UNMAS] Misurata Office, for all [Demining group] Teams to return to base for further planning.

At 0830 hours all [Demining group] personnel left Daphniya for their base and emergency planning commenced at 0920 hours at the [Demining group] base. A CLO was then asked to return to the site to gather further information to assist the planning. This CLO reported back at approximately 1030 hours that there may be Chinese Type 84 Scatterable Anti Tank Mines scattered around the area.

2.3 EOD Clearance operation Friday, 02 March 2012

[Demining group] EOD Teams 1, 2 and 3 and BAC 1 were tasked to investigate the UXO contamination around the small village of Daphniya, and then to develop and implement an emergency clearance plan. As this was an emergency task a verbal task order was issued by the JMACT Misurata Office on the morning of Friday 02 March 2012, in which the dangers of the Type 84 were discussed. An instruction was also clearly given that [Demining group] were not to enter the Police Station and the container area as delineated by the wall of the Police Station; this was within Task Area D2.

The [Demining group] EOD Teams deployed on Friday 02 March 2012, and conducted initial assessment operations. A safe area was identified to the East of the Daphniya checkpoint and the initial area to be investigated was along the main road itself. 2 x Type 84 mines were found on the Northern verge of the road, which had probably been placed there by locals. These were assessed by the [Demining Group Ops Manager] as being 'Safe to Approach' as the locals had already moved them, and they were sandbagged in place and marked.

The [Demining group] EOD Team 3 then proceeded to investigate the area around the School and Mosque, as this had been identified by the local authorities as a priority area to clear in order to allow their use again. This area was cleared and 1 x 107mm HEAT Round was removed from Task Area D1 to a safer storage area nearby.

Concurrent to this the other [Demining group] EOD personnel identified that the area of the Police Station, and the area immediately to the South of the containers within the Police Station was heavily damaged with significant UXO contamination within the container area. At this point the decision was taken to modify the agreed clearance plan based on the new information obtained on the ground, and the teams returned to base. This modification was the imposition of a prohibited sub-area in Task Area 2.

2.4 Task Dossier Misurata/003/2012

This clearance plan for the task dossier was developed by the [Demining group] Operations Manager in discussion with his EOD Team Leaders. The plan was then discussed with, and then approved by, the JMACT Operations Officer, Misurata [UNMAS Ops Manager] and the formal task dossier was issued late on Friday, 02 March 2012. This is at Annex C for reference. [Not included, but held.]

Of particular note in the task dossier is that:

- a) the task area had been formally sub-divided into risk areas;
- b) [Demining group] were instructed that within Task Area Delta 2, 'when the container area is reached all activity *will cease... awaiting a new Task Order from the JMACT to specially deal with the items in the containers and their surrounds.* (Quoted from the Task Dossier.)

2.5 EOD Clearance operation – Saturday 03 March 2012

[A timings and key events matrix has been omitted for brevity.]

The overview below (Image 3) is a close up image of the prohibited sub-area showing key locations.



Image 3: Prohibited Sub-Area Overview

2.5.2 Analysis of [the Victim's] activity

Image 4 below was developed by analysing the images on the SD Card recovered from the casualty's digital camera. The figures in yellow are the time, whilst those in red refer to the image number. (An accompanying CD contains all images relevant to the inquiry. These may be used to cross reference against this aerial photograph.) The images cover the time span from the commencement of operations until his last conversation with the Operations Manager.

Image 4: [the Victim] known activity map. [Held on record.]

Image 5 below was developed from interview evidence referring to the casualty's second approach into the prohibited area within Task Area 2. The prohibited area is outlined in red, and the position of the civilian witness is clearly shown.

Image 5: [the Victim] second approach track. [Held on record.]

3 Incident site conditions

3.1 Worksite layout and marking

The initial start point and ICP was just off the main road to the East of the area, whilst the task location itself was divided into five sub-areas D1, D2, D3, D4 and D5. Area D2 included the Police Station and its walled environs, which was specifically excluded from the clearance operation until a new Task Dossier for that particular area had been issued by the JMACT. Additionally ([Demining Group Ops Manager]) had included the Road immediately South of the Police Station within the [Demining group] interpretation of 'the prohibited area'.

Task Area D2 was marked with red and white warning tape, although this does not seem to have precluded local residents entering the area.

3.2 Ground and terrain

Flat terrain with hard compacted mixture of sand, soil and small stones. The incident location was on the southern edge of a small urban environment. To the south of the incident location there is a scrap yard of similar terrain.

3.3 Vegetation

No vegetation.

3.4 Weather

Clear Sky, No Cloud Cover, Bright Sunlight, Approximately 260C. Slight Breeze.

4 Team and task details

4.1 Team details

Task Manager: [Demining Group Ops Manager]

Medical Advisor: [Name removed]

EOD Team 3 Leader: [the Victim] (Deceased)

CLO: [Name removed]

Searchers: {Four Names removed}

Medic: [Name removed]

Also present on the task, but in the other Areas were:

EOD Team 1 Leader: [Name removed]

EOD Team 2 Leader: [Name removed]

Witness statements for the Team Members are at Annex D [Most are pictures: held on record but not included]. Included in these statements is one from a local resident [Name removed] who observed the casualty in the prohibited sub-area of Task Area 2 immediately prior to the explosion. [The Resident] observed the casualty walking from the end of the street being cleared by EOD Team 1 across the road to some destroyed containers South of the Police Station. [The Resident] did not see the physical explosion as this was hidden behind a container, but he saw the effects of smoke and debris.

Supplementary team information is contained within the following matrix:

1 Qualifications

Operations Manager and all 3 EOD Team Leaders at IMAS Level 3.

The fatality had qualified at IMAS Level 3 at the IMATC Course in December 2008.

2 Continuation Training

The fatality joined [Demining group] in October 2011

3 EOD Experience

The fatality was an EOD Operator with limited operational experience in Sudan (3 years) and Estonia (4 years prior to IMAS qualification). [The IMATC course is not an IMAS qualification, and the length of experience was not "limited". If he had seven years experience before getting an EOD Level 3 qualification in 2008 – he had extensive experience by 2012.]

4 In-Country EOD Experience

The fatality had been deployed in Libya since Nov 11 and had been involved in continual EOD operations since then.

5 Last leave period

16 Dec 11 – 04 Jan 12

6 Monitoring

EOD operations were regularly monitored by the QA/Operations Manager.

4.2 Task details

The task was to conduct EOD/BAC/MRE operations at the Daphniya Checkpoint and immediate surrounds. The boundary of operations was to be that of the area in as far as blinds and 'kick outs' had travelled. A sub-area (that of the Police Station and its walled environs) within Task Area Delta 2 was excluded from clearance operations pending the issue of a specific JMACT Task Dossier for the area. Full details are in the Task Dossier at Annex C [Held on record].

Little of the task was completed as the accident occurred at a very early stage of the clearance operation.

5 Equipment and procedures used

5.1 Equipment used

5.1.1 EOD equipment

[Demining group] had all the appropriate tools and equipment for the task. As surface search and in-situ destruction of UXO/ERW formed the task requirement no specialist equipment was required other than; 1) ladders; 2) hook and line set; 3) marking stores; and 4) demolition stores.

5.1.2 Personal Protective Equipment (PPE)

The use of PPE was directed in the Task Dossier. Protective Vests and Goggles were to be worn by all site personnel. Additionally a Protective Apron and Visor was to be used by EOD Operators on any manual approach to hook and line suspect UXO.

There is evidence that goggles were not routinely used during the task. [The investigator appears to be in error: IMAS compliant goggles were not available to this group but visors were.]

5.2 Procedures used

[Demining group] Libya SOP Explosive Remnants of War (ERW) Clearance, SOP General EOD Safety Precautions and SOP General Information Demolition, Materials and Accessories were being applied. These SOPs had recently been updated and no significant omissions from the SOPs were identified.

5.3 Work routines

The previous days operations had finished mid-afternoon. The sequence of events on the day of the accident was as follows:

- 0715: Task briefing at [Demining group] HQ Libya, including specific warnings on the hazards of the Type 84. Specific instructions were given to all team personnel that on encountering a Type 84 they were to immediately withdraw and notify the [Demining Group Ops Manager].
- 0730: Departure for Daphniya Task Location.
- 0810: Arrival at Daphniya Task Location. The new Control Point (CP) was checked for UXO/ERW by EOD Team 2 and 3 Leaders [the Victim] and [Name removed].
- 0820: CP declared safe and all staff and vehicles move forward.
- 0825: Final run through of the planned operations at the task site.
- 0830: Operations commence.
- 0935: Time of Accident.

6 Explosive hazards involved

There is little doubt, based on; 1) photographs prior to the incident; 2) the damage to the body; 3) recovered forensic evidence; 4) observed cloud shape and colour after detonation; and 5) technical analysis, that one (or possibly more) Chinese Type 84 Scatterable Anti-Tank Mine(s) were the cause of the explosion. (See Paragraph 12 Discussion for further information).

Open source information on the Chinese Type 84 is limited and contradictory. This particular mine will form the subject of a request for a future Technical Note for Mine Action (TNMA), in which all available data will be included and analysed. Of immediate concern to EOD Operators in Libya is the following;

a) the mine contains approximately 750g of high explosive contained within a 3mm steel body, although some have been found of a much lighter gauge metal of closer to 1mm;

b) a Misnay-Schardin plate, possibly steel, is included at the top of the mine. This means a danger area of over 1000m should be applied in the direction the plate is pointing, unless suitably barricaded or traversed;

c) open source information suggests there are a range of variants; 1) pressure initiated; 2) self deploying tilt rod and pressure operated; and 3) a magnetic influence fuze with an inherent anti-handling capability, which may be fitted with 4 to 72 hour a self-destruction system.

It is the technical opinion of the Board of Inquiry that the type of mine involved in this particular accident was the type fitted with the magnetic influence fuze with an inherent anti-handling capability.

7 Details of injuries

7.1 Casualty data

There was one fatality as a result of this accident. There were no other injuries due to this accident:

7.2 Summary of injuries

The medical reports developed by the Libyan national authorities were verbally translated to the BOI members and used to compile this section. Fully translated versions will be made available on request from the JMACT. [Not made available.]

See Annex E for Injury Data Sheet in accordance with Appendix 3 to Annex B of IMAS 10.60. Photographs of the casualty have been restricted to [Demining group] and the JMACT [UNMAS]. The Board of Inquiry has destroyed all other electronic copies made for investigative purposes. Photographic evidence to support his report will be distributed only to JMACT [UNMAS] and [Demining group]. The codes that follow in the text, for example (M5), refer to the image record in the restricted photographic supplement to this report. [All photographs are held on record.]

There was a massive traumatic wound to the front left quadrant of the head (M34 and M35); there were no burns or charring. Medical opinion is that this was the cause of death and that life would have expired instantaneously. The injury displays the typical indications of fragmentation injury. Experience of the Board of Inquiry members on past accident investigations suggests that this could possibly be due to the Misnay-Schardin plate being projected at high velocity (4000 – 5000 m/s) from a Type 84 mine; the size of the wound would be conducive with an explosively formed projectile (EFP) from a 118mm diameter warhead. But another source of high velocity fragmentation certainly cannot be excluded on the limited evidence available.

The fingers of the right hand were removed by traumatic amputation (M22); this injury is consistent with high velocity fragmentation damage. The remainder of the right hand and thumb was relatively undamaged (M22). There were no burns or charring to the right hand. The left hand was undamaged (M21).

There was significant blast damage, burning and charring to the lower right leg (M18), suggesting that this was very close to a seat of the explosion on, or just above, the ground. The right arm had suffered high velocity fragmentation injuries just above the elbow (M26).

There were numerous, low velocity fragmentation impacts to the body on the right hand side (M25).

The casualty was found lying on his back (M10) with his head covered by the lower half of his protective vest. The blast wave from the explosion had lifted this up and over his head, again suggesting the seat of explosion been on, or very close to, the ground. Both the front and rear of the protective vest had been lifted; his head was laying on the back section of his jacket (M13) and the front section was covering his face.

8 Equipment / property / infrastructure damage

- 1 Kevlar PPE Vest: Fragmentation and Blast: \$500
- 2 Digital Camera: Blast effects have damaged the internal circuitry beyond repair:
\$1,000
- 3 Single Width Breeze Block Wall 5m Length of wall demolished or weakened: \$300

TOTAL (Estimated) \$1,800

9 Medical and emergency support

Appropriate medical support was available and present at the time of the accident. Present were the [Demining group] Medical Advisor and the EOD Team 1 Medic. The casualty was discovered at approximately 0935 hours, and was evacuated to Misurata Hospital at 1015 hours. Repatriation of the body took place on Wednesday, 07 March 2012.

The immediate medical response to the explosion was hasty and uncontrolled in that the Community Liaison Officer (CLO) and Team Medic both independently, although at different times, moved into the hazardous area when they saw the casualty. They were both immediately, although again at different times, removed by the [Demining Group Ops Manager]; who used this time in the hazardous area to assess the injuries to the casualty and conclude that there were no signs of life. A safe route was then cleared to and around the casualty by the Operations Manager, EOD Team 2 Leader and one searcher. The medical team [Two names removed] were then briefed and escorted to the casualty.

The casualty was then assessed by the Medical Advisor, whose professional opinion was that the individual was deceased. The body was then placed on a stretcher, covered and evacuated to the ambulance along the safe, cleared route. The Medical Advisor accompanied the body to Misurata Hospital, where he remained until local emergency trauma medical staff confirmed life extinct.

10 Reporting procedures

10.1 Initial incident report

[Demining group] attempted to follow the reporting procedures in accordance with IMAS 10.60. An initial verbal report was passed to the JMACT Misurata at 1021 hours on the day of the accident; this was approximately 45 minutes after the accident. This slight delay was due to cellular phone network coverage issues, which is a known problem in that area. This problem was also encountered by the Board members during their investigation.

An anomaly in the initial incident report is that the casualty was accredited to [Demining group] EOD Team 1, whereas he was actually in [Demining group] EOD Team 3. The potential of such misreporting is obvious. [The meaning of the sentence is unclear.]

10.2 Detailed incident report

It is a requirement of IMAS 10.60 that a detailed incident report be submitted normally within 10 days to the national authority, and that this be made available to the Board of Inquiry. As [Demining group] have appointed an independent nominee to the Board of Inquiry, and as this nominee is writing an internal [Demining group] report into the accident, in this case the Board is content not to receive this type of report from [Demining group]. [An internal demining group report existed at the time of this report and is held on record.]

11 Any other matters

11.1 Limitations on investigation

11.1.1 Identification of exact seat of explosion

It was not possible to positively ascertain the exact seat of the explosion; 1) because of the ammunition type (see later); and 2) because unknown individual(s) had entered the area on the night of 03/04 March 2012 to rake over and remove all signs of blood; (possibly this is to protect individuals and domestic animals from contamination). Evidence recovered allows identification to within 1 or 2 metres.

11.1.2 Digital time stamps

Differing digital time stamps on the electronic camera system image evidence made the time line reconstruction of events more complex than should be necessary.

11.2 Self-destruct 'soak times'

The Type 84 mines in this immediate area were in effect laid as a result of the explosion between 2100 and 2200 hours on 29 February 2012.

Based on reports of explosions from local residents and evidence at the site it has been confirmed that other Type 84 Mines ejected as a result of the initial explosion self-destructed after 72 hours. These explosions were reported between 2100 and 2200 Hours on Saturday 03 March 2012. The accident explosion occurred approximately 60 hours after the initial explosions at the Daphniya Police Station; this is within the 'self-destruct' period.

These recent events in Daphniya have now confirmed that a variant of the Chinese Type 84 ATM that may be encountered in Libya had a self-destruct period of up to 72 hours.

11.3 Forensic evidence

11.3.1 Physical evidence recovered

1) Digital Camera: The camera was close enough to the blast to suffer internal and external damage. Digital imagery recovered from the SD Card. [Held on record.]

2) Blood-stained man-made fibre from Chinese 122-15 ATML Rocket Warhead. The fibre was recovered from the clothing of the casualty by the hospital. Comparison against fibres recovered from an exploded carrier warhead showed an exact visual match. This strongly suggests that the munition(s) that detonated was still within, or very near to, a damaged carrier warhead. The warhead body is made of thin metal, covered in spun man-made fibres. The sample recovered from the body is NOT that shown on photographs of the casualty's throat region.

3) Blood-stained clothing from the casualty. The clothing clearly showed that the blast occurred on the right-hand side of the casualty. Further evidence as to exact body position could not be obtained from this evidence.

4) Fragmentation recovered from the casualty. One of the fragments probably came from a Type 84 mine.

A second fragment possibly came from the 122-15 ATML rocket.

Efforts were made to recover the Kevlar PPE vest for inspection, but the Board of Inquiry could not identify the appropriate local authority responsible in the time they had on the ground.

11.3.2 Imagery

Digital imagery was recovered from the SD card in the casualty's digital camera; the SD card will be archived with the Board of Inquiry report. There is also extensive digital imagery of the area by JMACT Misurata prior to, and subsequent to, the accident that assisted the investigation.

11.3.3 Engineering software analysis

Data from Kingery and Bulmash (Kingery and Bulmash, 1984, Airblast Parameters from TNT Spherical Air Burst and Hemispherical Surface Burst) equations was used to estimate the blast parameters of a Type 84 ATM and the effects to be expected on individuals (7Sedman A, 2006, Plot Showing Estimates of Mans Tolerance to Blast in Terms of TNT Charge Size and Distance). TNT Equivalence of 1.1 was used.

[A table is omitted because it's estimates of damage are not relevant – the device involved in the accident and its effects on the victim were known with reasonable confidence.]

The medical report confirms that the casualty had suffered eardrum rupture and blast lung damage, which places the casualty within at least 3m of the explosion.

11.4 External pressures

Although the area was occupied, with constant traffic on the main road, the [Demining group] Operations Manager confirmed during interview that he did not feel under any pressure to compromise operational or render safe procedures in order to complete the task.

11.5 Compliance with SOPs

11.5.1 Magnetic influence

The casualty entered the prohibited sub-area within Task Area D2, positively confirmed as containing Chinese Type 84 ATM, carrying; 1) a metal 'Leatherman' multi-tool; 2) a battery operated digital camera; and 3) a battery operated radio. Notwithstanding the probable cause arrived at in this report, this amount of metallic content may have being enough to initiate the magnetic influence fuze of other Type 84 mines should the EOD Operator have been close enough.

Conversely, evidence from another [Demining group] EOD Operator on the same task states that he divested himself of all metal contents and radios before proceeding into task areas.

11.5.2 Goggles

There was photographic evidence that [Demining group] personnel on task, including the fatality, were not wearing protective goggles as ordered in the Task Dossier. Whilst the wearing of protective goggles would not have saved the fatality it is still a significant breach of SOP that could have implications in the future and therefore should be commented on. [The group did not have IMAS compliant goggles but did have visors.]

12 Discussion

12.1 Type of munition involved in the explosion

It is the opinion of the Board that the ammunition involved in this accident was a damaged Chinese manufactured 122-15 ATML Rocket containing 6 x Type 84 Scatterable Anti-Tank Mines. It is also the technical opinion of the Board that at least one, or more, of these mines detonated.

12.2 Initiation of munition options

12.2.1 Initiation of self-destruction system?

The initiation of the self-destruction system due to time expiration whilst the EOD Operator was in the immediate vicinity of a Type 84 mine is considered to be highly unlikely. Although detailed technical knowledge of the self-destruction system is not available, the fact that other armed Type 84 on the site self-destructed at the end of the 72 hour period suggests that this was a 'standard' or pre-set time for this particular batch of 122-15 ATML warheads. No other Type 84 detonated on this site at, or around, the time of the accident.

12.2.2 Initiation of anti-disturbance system?

Although the Type 82 mines were still contained within the carrier rocket prior to the accident, arming of one or more of these mines cannot be excluded due to the damage sustained to the carrier rocket.

The traumatic amputation of the fingers on the right hand of the casualty suggest that he was very close to, or in direct contact, with part of the damaged ammunition at the moment of explosion.

12.2.3 Initiation of magnetic influence system?

The fatality had a range of metallic objects on his person at the time of the explosion. (Radio and Battery, Camera and Battery, and 'Leatherman' Multi-Tool). This makes it possible that, if the fatality approached within a specific but unknown range, the amount of metal on his person altered the magnetic flux of the magnetic influence fuze in an armed mine within the carrier warhead.

12.2.4 Comment

It is the technical opinion of the Board of Inquiry that there were three possible options for the cause of the explosion that resulted in the fatality:

- a) direct handling of part of the damaged 122-15 ATML Rocket, resulting in the initiation of the anti-disturbance fuze of an armed Type 84 mine within the damaged carrier warhead; or
- b) the approach of the fatality in the close vicinity of the damaged 122-15 ATML Rocket caused the movement of loose ground under the ammunition that resulted in the initiation of the anti-disturbance fuze of an armed Type 84 mine within the carrier warhead; or
- c) initiation due to a change in the magnetic flux of the magnetic influence fuze of an armed Type 84 mine within the carrier warhead; this change been due to the presence of metal on the fatality and his close proximity to the munition.

12.3 Probable cause of initiation

There is limited factual, imagery or forensic evidence to be able to state with 100% confidence the exact final sequence of events undertaken by the fatality immediately prior to the accident. There is, however, enough evidence available to allow for interpretation and analysis leading to an assessment of the probable cause of the accident.

The casualty was probably kneeling or squatting next to the damaged 122-15 ATML Rocket facing North-East. The open end of the damaged, but burnt out, rocket motor in front of the fatality, with the damaged carrier warhead to his rear. The rocket is laying in a North-East to South-West plane.

The charring of the leg wound, and its angle, suggests that the right leg was very close to the point of explosion, as such burning would not normally be expected outside the radius of the fireball. The wound was also as a result of some fragmentation.

The fragmentation damage to the casualty's left buttock can also be explained by this body position as there would be clear line of sight from the buttock to the warhead of the damaged rocket.

The torso of the casualty was above the seat of explosion. The evidence to support this is that the PPE Kevlar Vest had been blown upwards and inverted on both sides of the body by the blast wave from the point of explosion. The Kingary and Bulmash analysis (Paragraph 11.3.3) suggests that the blast overpressure from even one mine would certainly be sufficient to achieve this. This blast overpressure would also be sufficient to rotate the casualty through the 1800+ necessary for the casualty to have achieved his final position lying on his back. This rotation would not have taken place until the other wound mechanisms discussed below had been sustained.

The damage sustained by the casualty to his right hand could have been caused by him lifting the rocket by the open end of the burnt out rocket motor. Fragmentation from the expulsion system at the base of the warhead, or by the Misnay-Schardin plate from the first (lower) Type 84 mine in the damaged carrier warhead could then have traumatically amputated the fingers by kinetic energy attack. The surgical type of fragmentation, and lack of charring suggest a kinetic energy attack as the likely wound mechanism for this damage.

The wound to the front left quadrant of the head (the right hand side when viewed looking at the casualty), could then have been caused by fragmentation from the expulsion system at the base of the warhead, or by the Misnay-Schardin plate from the first (lower) Type 84 mine in the damaged carrier warhead. The lack of charring or burning, combined with the precise delineation of the outer edges of the wound, suggests that this damage was caused by kinetic energy attack rather than blast. These injuries would be consistent with the casualty kneeling, supported by his left hand, whilst starting to look down into the empty damaged rocket motor. If kneeling to the right of the rocket motor, the natural inclination would be to look into the motor with the left eye after rotation of the head.

The empty rocket motor body would then have been destroyed by this blast, and the blast would have projected the remainder of the Type 84 mines around the already contaminated Area D2.

It may not have been the first mine at the lower (base) end of the damaged carrier warhead that initiated, as it is possible that this mine was initiated by the shock wave from the second mine in the body as that initiated. It is unlikely that the shock wave resultant from the initiation of the 'armed' mine would initiate all other mines in the carrier warhead, as this shock energy would be rapidly dissipated. Self-sustaining chain reaction explosions are rare in these types of incidents.

There is also evidence from EOD Team Leader 2 that the cloud formation and colour was typical to those he had seen during the demolition of similar Type 84 mines. There is also verbal evidence from some of the Searchers in BAC Team 2 that the explosion was much louder than normally heard from a detonation of a single Type 84 mine.

12.4 Contributory factors

Contributory factors are not directly the cause, but contribute to the course of events leading to the accident. Contributory factors, or possible contributory factors, have been identified by considering whether the outcome would, or might be different, if the factor under examination had not been present.

12.4.1 Stockpile location

The presence of an ammunition stockpile containing UN Hazard Division 1.1 high explosive ammunition within an urban area, and so close to a main traffic route, is considered to be a significant contributory factor. If such an event had occurred within an ammunition storage area located in accordance with international best practice the 'kicked out' ammunition would have landed within the already accepted danger area. No civilians would have been placed at risk, and therefore there would have been no requirement to clear the area as an emergency task.

12.4.2 Application of appropriate 'soak times'

The main contributing factor was the commencement of EOD operations before the expiration of the 72 hour self-destruct time. Once Type 84 ATM had been positively identified at the scene all operations should have ceased until expiration of the 72 hours, plus a margin for error of an additional 12 hours.

12.4.3 Loss of task control

A contributing factor was a loss of task control by the Operations Manager ([Demining Group Ops Manager]) when the casualty entered the prohibited sub-area within Task Area D2 unobserved for the second time.

12.4.4 EOD Operator indiscipline

A major contributing factor was that the casualty unilaterally decided to enter independently, without authority, in the prohibited sub-area of Task Area 2; an area that he had been specifically briefed by the Operations Manager ([Demining Group Ops Manager]) not to enter.

12.4.5 Lack of technical intelligence

The lack of technical intelligence on the specific munition involved in this accident meant that a range of appropriate, yet definitive, render safe procedures for all scenarios still can not be developed. This lack of technical intelligence is a global issue for Mine Action, and the fact that Humanitarian Mine Action personnel have to resort to using old 'military' contacts or social networking sites to obtain information on ammunition they are unfamiliar with means that EOD Operators and Deminers are not been provided with the appropriate level of technical support.

12.5 Aggravating factors

Aggravating factors are those that adversely affect the outcome of the accident; for example the non-wearing of personal protective equipment (PPE).

No aggravating factors were identified by the Board of Inquiry.

13 Conclusions

1) EOD clearance operations commenced in an area known to be contaminated with Chinese Type 84 Scatterable Anti-Tank Mines before expiration of the self-destruct delay period. Although consideration was given by both JMACT [UNMAS] Misurata and [Demining group] Libya as to the impact that the self-destruct capability could have on the operational response. Notwithstanding this, operational activity still took place within the danger area of a damaged Chinese 122-15 ATML Rocket and individual Chinese Type 84 Scatterable Anti-Tank Mines;

2) the fatality was as a result of an unauthorised entry into a UXO contaminated area by the fatality and subsequent handling or movement within the immediate proximity to a probably armed Chinese Type 84 Scatterable Anti-Tank mine(s) contained within a damaged Chinese 122-15 ATML Rocket. This handling or close proximity leading to the initiation of one or more Type 84 mines within a damaged munition;

3) the mine was most likely initiated by either; 1) the initiation of the anti-disturbance/anti-handling system within an armed mine(s) by the EOD Operator handling a damaged rocket; or 2) the metal content carried by the EOD operator initiating the magnetic influence fuze by approaching the mine within the effective distance of the fuze¹⁰. It is the technical opinion of the Board that Option 1 is the more credible scenario;

4) expiration of life in the fatality was virtually instantaneous;

14 Recommendations

The following recommendations are in no specific priority order, and all should be implemented as soon as is practicable:

a) JMACT Libya. JMACT [UNMAS] Libya should immediately issue further technical guidance to all stakeholders on the known hazards of Chinese Type 84 Scatterable Anti-Tank Mines;

- b) UNMAS. An URGENT Technical Note for Mine Action (TNMA) should be developed on the system by GICHD, to include recommended Render Safe Procedures (RSP);
- c) UNMAS. UNMAS should, as a priority, investigate a system of making appropriate technical intelligence available to EOD Operators and Deminers on a timely basis;
- d) UNMAS. UNMAS should ensure that an amendment is made to the appropriate IMAS to state that digital time stamps on computers, digital recorders, GPS and electronic imagery (camera) equipment etc should be synchronised on a routine basis;
- e) UNMAS. The speed with which [Demining group] arranged access to post critical incident debriefing and counseling access should be commended. UNMAS should consider including this level of response in IMAS as a requirement after all accidents resulting in either fatalities or very serious injuries;
- f) [Demining group]. Although [Demining group] have recently reviewed their EOD SOPs they must ensure that ALL of their EOD Operators are made aware of the risks and hazards of physically moving UXO. Their EOD Operators must also be regularly reminded of the inherent risks and hazards of approaching possible armed ammunition types of which they have insufficient technical knowledge.
- g) [Demining group]. [Demining group] should ensure that medical rehearsals are routinely and effectively carried out in order to reduce the risk of a future uncontrolled immediate response to an explosion involving a team member;
- h) [Demining group]. The Operations Manager and Team Leaders must ensure that ALL team members wear the PPE that has been specifically recommended and agreed for a particular task.

[Signed for UNMAS New York and JMACT UNMAS Libya.]

[The [Demining group] brought a consultant to serve as their representative on the Board. An LMAC and Misurata Council Representative were also present].

Victim Report

Victim number: 986	Name: [Name removed]
Age: 31	Gender: Male
Status: supervisory	Fit for work: DECEASED
Compensation: Not made available	Time to hospital: Not recorded
Protection issued: Long visor	Protection used: Frontal apron

Summary of injuries:

INJURIES: severe Arm; severe Body; severe Hand; severe Head; severe Leg

AMPUTATION/LOSS: Fingers

COMMENT: See Medical report

Medical report

A death certificate is held on record.

The BOI report includes the statement:

There was a massive traumatic wound to the front left quadrant of the head (M34 and M35); there were no burns or charring. Medical opinion is that this was the cause of death and that life would have expired instantaneously. The injury displays the typical indications of fragmentation injury. Experience of the Board of Inquiry members on past accident investigations suggests that this could possibly be due to the Misnay-Schardin plate being projected at high velocity (4000 – 5000 m/s) from a Type 84 mine; the size of the wound would be conducive with an explosively formed projectile (EFP) from a 118mm diameter warhead. But another source of high velocity fragmentation certainly cannot be excluded on the limited evidence available.

The fingers of the right hand were removed by traumatic amputation (M22); this injury is consistent with high velocity fragmentation damage. The remainder of the right hand and thumb was relatively undamaged (M22). There were no burns or charring to the right hand. The left hand was undamaged (M21).



There was significant blast damage, burning and charring to the lower right leg (M18), suggesting that this was very close to a seat of the explosion on, or just above, the ground. The right arm had suffered high velocity fragmentation injuries just above the elbow (M26).

There were numerous, low velocity fragmentation impacts to the body on the right hand side (M25).

[Photographs showed fragmentation wounds to the lower abdomen. Left hand thumb tip injury and fingertip discolouration, severe fragmentation to chest, neck and underarm. Right arm almost severed at elbow, penetration wounds to left foot top and heel, severe upper right leg fragmentation wounds and tears, and severe lower back penetration.]

Demining organisation name:
 Location (province, district, village, task no): DAPHNIYA
 Casualty name or CIN:
 Explain the cause of injury (ies): See note 2

Organisation sub unit, site office/project number, team name/number: EOD TEAM 3
 Date and time of incident: 03 March 2012 0935 hrs
 Gender and age: M / 31

Code	Meaning
A	Abrasions
AM	Amputation
TAM	Traumatic amputation
B	Burn/discolouration
D	Dislocation
F	Fracture
FR	Fragment
H	Haemorrhage
IH	Internal haemorrhage
L	Lacerations
LO	Loss of function

[The inadequate IMSMA report is shown above.]

Medic's statement

English translation:

Misrata, the 3rd of March 2012

On Saturday morning, the 3rd of March 2012, during clearance at the location of Dafnia, a huge explosion is heard around 09.30 am. There had been talks about the possibility of needing to arrange explosions, but as nothing such had been announced via radio communication, I call all-call signs for radio check. Rapidly there is response from [Name removed] (call sign C1), where after a CLO, [A searcher], repeatedly is calling (shouting): [Name removed, the Victim]. [Name removed] is calling for the ambulance. The ambulance is driving forward while several people starts running towards the scene of the accident; they are stopped by and only [Supervisor] and I (call sign MO) is proceeding with care. At the scene of the accident a medic, [Name removed], has started creating a tourniquet. MO is very quickly able to establish there are injuries inadequate with continued life. And all are being pulled back to the containment area. [Supervisor] and MO decides on a plan of evacuation where [Name removed] and a local staff makes a corridor and marks potential UXOs with red and marks an area of operation around the scene of the accident. medic [Name removed] and MO move [the Victim] to a stretcher, covers him and takes him out via the corridor under the surveillance and guidance of [Supervisor]. [The Victim] is moved to the hospital in Misrata where he is handed over to the responsible doctor. After this [the Victim] is moved to a refrigerated room where he is undressed and several massive injuries are apparent and visible. After this [the Victim] remains with the local authorities (official doctor and the police who will investigate the incident). The interpreter, driver of the ambulance, Medic and MO is being questioned by the police. It is being informed that is might be possible to get access to [the Victim] and the filled out documents by tomorrow, the 4th of March at 10.00 AM.

Signed: Medical Advisor.

Related Papers

[All Annexes are held on file.]

Annex B: [Demining group] Initial demining incident report

Transcript of E Mail Sent

Date & time report submitted 05.03.2012 19.00

From: [Demining group] Humanitarian Mine Action Programme Libya

To: LMAC, UNMAS Tripoli Libya (JMACT)

Subject: Demining incident initial report

1. Organisation sub unit, site office/project number, team name/number.

[Demining group] HMA Operations Misurata, Libya. Team 1

2. Location (province, district, village, task no).

Dafnia, Zliten. Spot Task (documentation currently unavailable)

3. Date and time of incident.

Approx.. 08.30 am 03.03.2012

4. Details of casualty(ies) to include:

Names or casualty identification numbers (CIN).

[The Victim]

Description of injuries.

Fatal blast/fragmentation injuries to major parts of the body

Treatment given.

Death occurred immediately, no action of treatment.

Current condition of casualty(ies).

N/A

4. Evacuation methods, routes, destinations and estimated arrival times.

Transport by road accident site – Misurata Hospital, Misurata – Tripoli Repatriation expected to be completed Wednesday 07.03.2012

5. List equipment/facilities/infrastructure damaged.

NTR

6. Describe how the incident occurred.

Accident occurred during survey/BAC search

7. Contact details of key personnel.

[Demining group] HQ: [Name removed] HMA + [Number removed] Libya: Name removed, Operations Manager +[Number removed]

8. Any other information including:

Details will follow, external and internal investigation in progress.

[Signed for Demining group.]

Annex D: Witness Statements

Statements (apart from the Medic's) are held in scanned form, so cannot be made anonymous.

Annex F: Photographs

1. Source: [the Victim's camera]

The following pictures were recovered from the SD Card of the deceased digital camera. Analysis with other evidence (Image L37) suggests that the digital time for the camera was 22 minutes ahead of real time. Reconciled times were used for the development of this report.

[25 have been removed for brevity. Held on record.]



Armed Type 84 mine, still in the broken carrier.
condition.

Type 84 mine in unknown, but possibly armed,



K73 03/03/12 - 09:22
View through the hole in the wall towards the destroyed container area. This is the final picture found on the SD Card.

2. Source: [UNMAS Ops Manager], JMACT Operations Officer Misurata

[Photographs removed for brevity]



S10 03/03/12
Site of the accident with Leatherman tool and remains of detonated Type 84 mines.

[The investigators noted that the Leatherman was with the bloodstained remains of the detonated mines but did not mention it again.]

3. Source: BOI Team

[Photographs of fragments of metal and fibre recovered from the body have been removed.]

4. Source: anonymous

The following photograph was taken by a member of the local community and was handed over anonymously to [Demining group]. The existence of the rocket at the place of the accident was validated through the photographs K60 and S1.



Damaged Chinese 122-15 ATML Rocket suspected to be cause of explosions. The lower right part is an empty 130mm rocket motor, which was accelerated to the opposite wall.

Analysis

The primary cause of this accident is listed as “Other” because the Victim was deliberately interacting with the mine in defiance of the instructions of his supervisor. The secondary cause is listed as a “Management Control Inadequacy” because the management failed to control their own field supervisors (recognised as a “loss of Task control” by the investigators).

The discrepancies between the witness statements and the time of the accident as originally reported by the Demining group, are noted as “Inconsistent statements”.

The investigation included some unusually well reasoned and cautious assessments of the device involved, with detailed links to the injury sustained used to determine the victim’s likely position. However, both were in fact pretty obvious. The Victim’s own photographs show that he saw the Type 84 mines in a rocket beforehand and then returned to them, so the device involved was not really in question: his activity at the time might have been. The investigation has been recorded as “inadequate” for two reasons:

1) It made no mention of an accident that occurred on 2nd November 2011 in Mizurata, Libya, when another international staff member working for the same Demining group was severely injured by the same type of mine. The Demining group’s failure to learn lessons from the previous accident was relevant and should have been noted. It is possible, for example, that the previous accident prompted the Victim of this accident to want to disassemble one of the mines and so understand better what happened in the first accident. The fact of the previous accident also reflects badly on the group management’s failure to control its staff in this event. See DDAS Accident 794.

2) The investigators ignored the fact that the Victim of this accident had his leatherman multi-tool at the time. It appears in photographs amid the device debris, stained by blood, but the implication that it was in use at the time was not even considered in the report.



The concern about the susceptibility of the device to initiation by the faint electromagnetic influence of a stainless steel hand tool, his radio or cell phone was made much of. Designed to be initiated by the electrical influences from a large armoured vehicle, this was always extremely unlikely. Subsequent tests conducted by UK Government specialists appear to confirm this. The Demining group management interviewed by the DDAS researcher (shortly after the event) preferred this explanation to the more obvious conclusion that the Victim was deliberately interacting with the device. As the accident record shows, deliberate interaction is a common cause of severe injury and death among highly experienced international staff. Failure to recognise this is not likely to lead to controlling it.

When researching this accident, this Demining group's management seemed more concerned about limiting damage to their reputation than about revealing and sharing the truth in order to avoid repetition. UNMAS seems to have agreed with them, marking each page of the report "Restricted" and making it difficult for the Libyan authorities to access it during my time advising them. The management refused all access to the report of their earlier accident with this mine in Libya. See DDAS Accident 794.

The Libyans produced a technical note of the Type 84 AT mine very quickly after the accident. It is not known whether UNMAS acted on its own advice to do so.